Workforce Commuting and Subjective Well-Being

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Abstract

Commuting to and from work can constitute a significant proportion of a person's day and can have a considerable impact on one's well-being. Using the UK Time Use Survey (UKTUS) dataset, the experienced well-being effects of commuting, in terms of enjoyment, were evaluated relative to other daily activities. Commutes using passive modes of transport (e.g., car, train) were found to be the least enjoyable activities carried out in the day. Commuting using active modes of transport (e.g., cycle, walk) was also amongst the least enjoyable activities, although enjoyment of active commuting was significantly higher than that of passive commuting. This paper also assessed differences in the experienced well-being of other daily activities (such as working and physical exercise) during the workday between those who did and those who did not commute. Using a series of multilevel analyses, commuting was shown to have little impact on an individual's enjoyment of the other daily activities in which they partake. Enjoyment of all daily activities was found to be just as high on workdays on which participants commuted using active modes of transport as on non-commuting workdays. With the exception of only *Personal Care* activities and *Sleep*, there were no meaningful differences in enjoyment of any daily activities between any of the three commuting workday groups and non-commuting workdays.

Keywords: commuting, experienced well-being, subjective well-being, time use survey

Workforce Commuting and Subjective Well-Being

Commuting to and from work is a routine part of daily life for over 80% of the UK workforce, which equates to 21.5 million residents (as of 2011; Office for National Statistics, 2014a). The average daily two-way commute lasts 57 minutes, and the number of employees with daily commutes lasting over two hours increased by almost a third between 2010 and 2015, rising to 3.7 million in total (TUC, 2016). A growing body of evidence shows that commuting can be detrimental to people's well-being and overall life satisfaction. Indeed, recent studies based on large scale national surveys show that commuting duration is negatively associated with subjective well-being, and that the magnitude of this effect outweighs the economic benefits of traveling to and from work, such as cheaper housing and higher pay (Bryson, Clark, Freeman & Green, 2016; Morris and Guerra, 2015; Roberts, Hodgson & Dolan, 2011; Stutzer & Frey, 2008). More specifically, commuting contributes to elevated stress levels, and more so if a person travels by car rather than a bicycle or public transport (Avila-Palencia *et al.*, 2017; Legrain, Eluru & El-Geneidy, 2015). Not all studies agree, however; Ory *et al* (2004) report that a certain portion of the population enjoy the activity of commuting and Olsson *et al* (2013) found feelings during commutes to be predominantly positive or neutral.

In recent years, much insight into the psychological consequences of commuting has been generated by studies utilising variants of Day Reconstruction Methods (DRMs) for data collection (e.g., Kahneman, Krueger, Schkade, Schwarz & Stone, 2004). In a typical DRM methodology, respondents are asked to recall activities and experiences of the preceding day and then rate them on a range of affective-evaluative dimensions. Unlike most global measures of subjective well-being, DRMs reduce retrospective bias, which can occur if people are merely asked to describe their "typical" commuting experience (Stone & Schneider, 2016). Similarly, DRMs reduce practical difficulties associated with fully experiential methods, in which data

are collected from participants in real time. Crucially, data collected with DRMs allow for comparisons of the psychological impact of distinct events that occupy one's day.

Collectively, DRM studies have shown that commuting, in comparison to other daily activities, is detrimental to one's psychological wellbeing. Using a convenience sample of 1018 women, Kahneman *et al* (2004) found that out of 28 daily activities, commuting events were rated as the least positive in affect. In another study, White and Dolan (2009) showed that out of 18 daily activities, only shopping, housework and work were found to be less pleasurable than commuting. Stone and Schneider (2016) utilised the American Time Use Survey (ATUS) data and showed that commuting episodes were rated highly on stress and tiredness but low on meaningfulness dimensions. Finally, Bryson and MacKerron (2017) found that commuting ranked as 34th and 35th out of 40 activities in terms of happiness and feelings of relaxation. In this particular study, data were collected using experiential sampling, where participants were asked to report on their feelings of happiness, relaxation and alertness when prompted to do so by a mobile app. Out of all four studies reported above, only the work of Bryson and MacKerron (2017) was conducted with the UK population. As discussed in their paper, however, their sample was not representative of the UK population; those using the mobile phone application were wealthier and younger than the general public, with greater proportions being in full time employment or education. Key features of these four studies are summarised in Table 1.

Table 1

Key features of the previous studies that have compared daily activities based on their subjective well-being effects

Paper Authors, Year	Sample	Measures
Kahneman *et al*, 2004	Convenience sample of 1018 employed women	12 affect descriptors grouped into five categories: (1) Positive: Happy, Warm/Friendly, Enjoying Myself (2) Negative: Frustrated/Annoyed, Depressed/Blue, Hassled/Pushed Around, Angry/Hostile, Worried/Anxious, Criticised/Put Down (3) Competent (4) Impatient (5) Tired
White and Dolan, 2009	625 participants recruited via Web-based Internet panel run from a German university	Six Feeling Items: (1) Happy, (2) Nervous/Anxious, (3) Sad/Depressed, (4) Content/Relaxed, (5) Frustrated, (6) Impatient For It To End. Six Thoughts/Evaluations Items: (1) Focused, (2) Engaged, (3) Competent/Able. Felt the Activity Was (4) Worthwhile and Meaningful, (5) Useful to Other People, (6) Helped Me Achieve Important Goals. One Overall Episode Satisfaction Question
Stone and Schneider, 2016	American Time Use Survey - representative sample of 37,088 individuals living in the US	Six Well-Being Variables: Happy, Sad, Tired, Pain, Stress, Meaning.
Bryson and MacKerron, 2017	Mappiness smartphone app, more than one million observations from tens of thousands of individuals in the UK	Three Dimensions of Momentary Well-Being: How Happy, How Relaxed, How Awake

To date, no research has investigated whether carrying out the activity of commuting affects the enjoyment of other activities. A related study carried out in Sweden found that emotional responses during commutes have residual effects on mood immediately after the commute but not later in the day (Friman, Olsson, Stahl, Ettema & Gärling, 2017). In this study, participants completed three questionnaires: before the commute, immediately afterwards and one hour after the commute. Thus, the study assessed the time duration for which the residual effects are experienced; the study did not relate the effect of commuting to other specific daily activities.

The overall aim of the present paper is to examine the experienced well-being effects of commuting in the United Kingdom, in terms of how it compares to, and impacts on, other

daily activities. More specifically, this paper reports the results of analysis performed on data from the 2014-15 UK Time Use Survey (UKTUS), which consists of three main components: household interviews, individual questionnaires and diaries. UKTUS includes DRM data from 9,388 participants who completed over 16,550 diary days, rating 587,632 activity episodes on an enjoyment scale. The overall aim of the study is addressed by two objectives. The first objective is to compare experienced well-being, in terms of enjoyment, across different daily activities reported on by the respondents in the UKTUS. By doing so, previous findings are replicated using a new dimension of well-being (i.e. enjoyment) with a representative sample of the UK population. The second objective is to compare how the experienced well-being of various activities differs between workdays on which commuting is undertaken and workdays on which participants did not commute to/from work. This objective is enabled by the unique features of the UKTUS dataset; although the dataset includes only ratings on one dimension of experienced well-being, it contains ratings of all activities in any given individual's day.

Data

This study used the UK Time Use Survey (UKTUS) dataset (Gershuny & Sullivan, 2017). The survey was conducted in 2014-15 on a representative sample of individuals and private households across the UK. The survey was conducted by NatCen and the Northern Ireland Statistics and Research Agency (NISRA) on behalf of the University of Oxford's Centre for Time Use Research (CTUR), and the survey design follows the Harmonised European Time Use Survey (HETUS) guidelines (Morris, Humphrey, Cabrera Alvarez & D'Lima, 2016). The sample was drawn in two stages, firstly by random selection of postcode sectors and then a random selection of postal addresses within each of these.

Data from participants' diaries, which contained records for every 10 minutes of the 24-hour period, was the focus of the present paper. Participants were asked to note down their

primary and secondary activities, who they were with, where they were, whether they were using a smartphone/tablet/computer, and their enjoyment rating (on a scale of 1 to 7) of each activity. The enjoyment ratings were taken to be the measure of well-being evaluated in this study. UKTUS only contains ratings for this one positive affect measure. The scope of this study, therefore, does not extend beyond positive hedonic/experienced well-being to include negative affect or the other aspects of subjective well-being, namely evaluative well-being and eudaimonic well-being.

Participants were advised to fill out the diary as they progressed through the day, as opposed to filling it out at the end of the 24-hour period. In the data, multiple individuals could come from a single household. Individuals were asked to complete two diary days, one weekday and one weekend day; dates of the allocated days were randomly selected for each household.

When processing the data from the diaries, NatCen's Data Unit allocated the activities to 276 different activity codes. Activities were ordered using three levels; 11 Level 1 activities split up into 43 Level 2 activities and then further into 276 Level 3 activities. Each activity undertaken by a participant during the day, regardless of its duration, is referred to as an episode.

Commuting falls under the Level 1 activity *Travel*, the Level 2 activity *Travel by Purpose*, and is covered by three separate Level 3 activities: (1) Travel to/from work; (2) Travel to work from home and back only; and (3) Travel to work from a place other than home. The number of episodes of each of these three activity codes is presented in Table 2. In this study, commuting is taken as the sum of the three Level 3 activities.

Table 2

Number of recorded episodes for Level 3 commuting activities in UKTUS 2014-15

Level 3 Activity	**Number of Episodes**
Travel to/from work	315
Travel to work from home and back only	9,192
Travel to work from a place other than home	649
Total:	**10,156**

UKTUS includes participants who usually work (1) from home, or in the same grounds/buildings as home, (2) at a single workplace away from home, (3) in a variety of different places of work, such as on clients' premises or in their homes, and (4) on the move. Both workdays on which commuting does take place and workdays on which commuting does not take place consisted of participants from all four of these working location categories.

Data Preparation and Analysis

Both objectives of this study focus on the subgroup of the UK population who are employed; the sample was therefore limited to the individuals who stated that they were in employment. The entire dataset was filtered to include only those episodes (1) for which an enjoyment rating had been noted, (2) that took place on a weekday, (3) that took place on a day classified as a *Workday*, and (4) that were undertaken by participants who described themselves as *self-employed* or *in paid employment (full or part-time)*. Filtering the data to weekdays meant that only the weekday diary entry of each individual was retained, and individuals who only completed a weekend day diary entry were omitted from the study. The resultant dataset after filtering comprised of 1944 participants, significantly fewer than the original UKTUS sample. Sample characteristics, for both the full UKTUS sample and the filtered dataset, are presented in Table 3.

Table 3

Sample characteristics

	UKTUS	Filtered UKTUS for Present Study
Number of Participants	9,388	1,944
% Female	53%	45%
Age		
Age Range	8 - 99	17 – 83
Average Age	44	43
Education Level		
Degree or Higher	2,082	633
Higher Education	1,309	350
A-Level or Equivalent	1,525	381
Secondary	2,266	465
Employment Status		
Self Employed	701	327
Paid Employment	3,879	1,617
Unemployed	324	-
Retired	2,032	-
Full-Time Student	619	-
Marital Status		
Single, Never Married	1,948	392
Married/Cohabitating	5,071	1,359
Divorced/Widowed	1,321	190
Number of Children		
No Children	5,767	1,190
1 Child	1,440	340
More than 1 Child	2,181	414
Self-Reported Health		
Very Good	3,414	776
Good	3,818	864
Fair	1,591	272
Bad	439	27
Very Bad	117	2
Long Term Health Problems or Disabilities		
No	6,203	1,431
Yes	3,154	506

When addressing the first objective of this study, evaluating the enjoyment of commuting relative to other activities, only data from commuting workdays was used. For the second part of the study, focusing on the effect of commuting to/from work on the enjoyment of other activities, data from both commuting and non-commuting workdays was used.

In the first part of the study, active commuting and passive commuting are treated as two separate activities to be compared with other daily activities. This part of the study focuses on activity episodes, irrespective of the nature of the commute on the workday on which they

occur. In the second part of the study, episodes occurring on commuting workdays were split into those occurring on days when the commute was carried out using passive (non-physically exerting) modes of transport (i.e., car driver, car passenger, train, bus, van and tram/underground), those occurring on days when the commute was carried out using active modes (i.e., walking and cycling) of transport and those occurring on days when the commute was carried out using both passive and active modes of transport. Multilevel analysis was carried out for each of the three groups separately.

Categorising commutes based on the transport mode provides a more nuanced understanding of the activity than just a single broad commuting category. The use of passive and active modes of transport to split the commutes creates easily understandable groups and actionable findings that would allow, for example, individuals to adapt their own behaviour and for organisations to promote transport plans that enhance well-being amongst their employees. Splitting the data in this way makes results regarding other activities more meaningful, for example, the level of exertion required in the commute may have a direct impact on the level of engagement in other active activities, such as *Sports and Outdoor Activities*. Details of the data are presented in Table 4.

Table 4

Summary of the filtered data used in the present study

Number of:	**Commuting Workdays**	**Non-Commuting Workdays**	**Total**
Passive Modes			
Workdays	1,282	435	1,717
Episodes	40,227	13,141	53,368
Commuting Episodes	3,112	-	3,112
Active Modes			
Workdays	227	435	662
Episodes	7,091	13,141	20,232
Commuting Episodes	508	-	508
Both Active & Passive Modes			
Workdays	264	435	699
Episodes	9,689	13,141	22,830
Commuting Episodes	1,465	-	1,465

Results

How Commuting Compares to Other Daily Activities

The first objective of this study was to compare the subjective ratings of enjoyment of all activities within the UKTUS dataset. Each Level of activity categorisation was assessed in turn. Results for the Level 1 analysis addressing this objective are plotted in Figure 1; the plot includes all Level 1 activities, as well as the categories of Passive Commuting and Active Commuting (combinations of the three commuting Level 3 activities), for which there were at least 100 recorded episodes. The activity *Travel* does not include commuting trips.

The results show that commuting by passive modes of transport ranked as the least enjoyable daily activity with the mean enjoyment rating of 4.45 (SD = 1.51). Commuting carried out using active modes of transport, however, ranked fourth from the lowest. More significantly, the mean enjoyment rating of 4.77 (SD = 1.46) was 0.32 points higher, on the scale of 1 to 7, than the corresponding figure for passive modes.

Travel for non-work related purposes was rated as considerably more enjoyable than commuting; 0.56 points and 0.24 points higher than passive and active commuting respectively. Employment ranked second from the lowest, 0.27 points higher than worst placed passive commuting but not significantly lower, in terms of average rating, than active commuting.

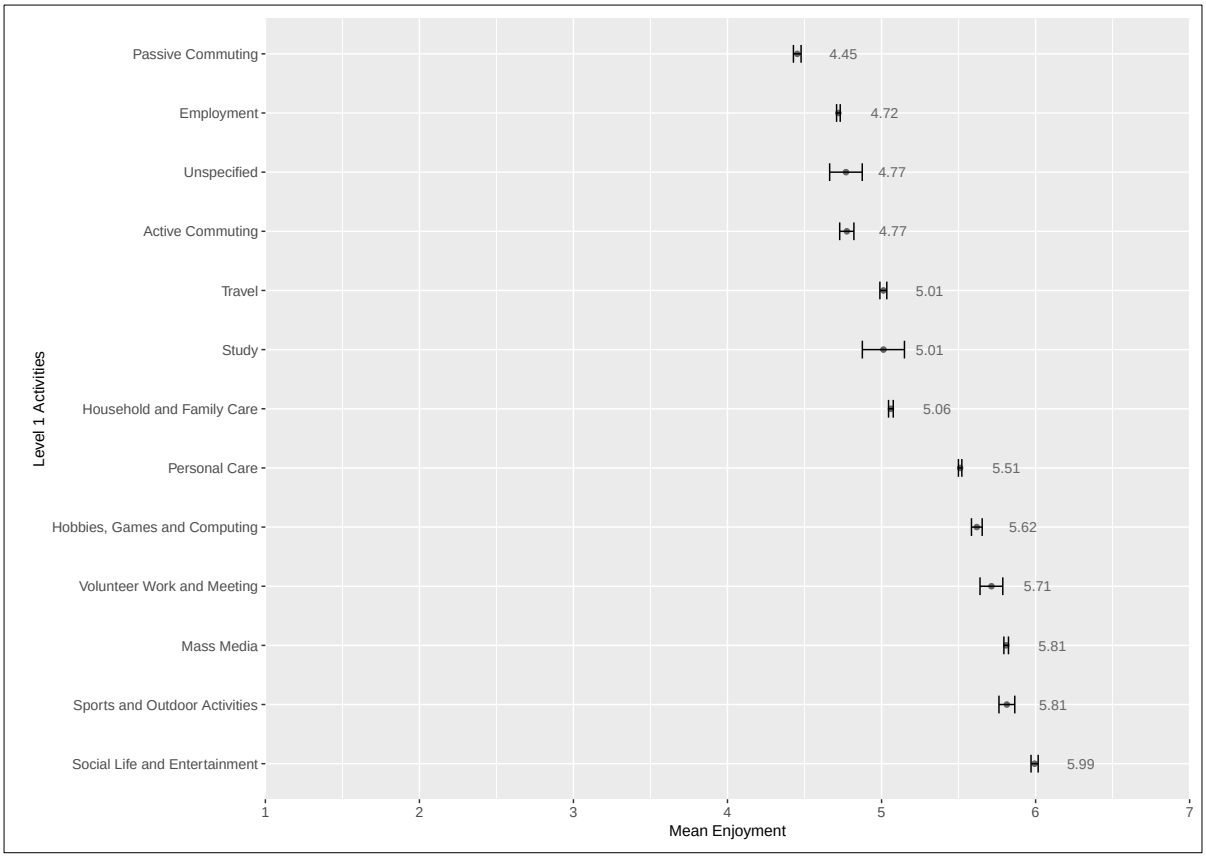

Figure 1. Mean enjoyment ratings by Level 1 activity. Error bars indicate one standard error.

Mean enjoyment ratings for Level 2 and Level 3 activities, for which there were at least 100 recorded episodes, are presented in Figures 2 and 3 respectively. At Level 2 analysis, only the *Making and Care for Textiles* - which includes laundry and ironing - and *Unspecified Household and Family Care* categories, ranked lower than passive commuting; mean enjoyment ratings for all remaining activities were higher. Active commuting ranked seventh from the lowest.

At Level 3 analysis, all three passive commuting categories had at least 100 recorded episodes and were included in the analysis; only one of the active commuting categories was included in the analysis. The lowest ranking Level 3 commuting activity was for passive modes of transport and ranked third from lowest, with *Personal Services* and *Ironing* ranking lower, as can be seen in Figure 3. The other two Level 3 passive commuting activities ranked as 8th

and 14th from the worst. The Level 3 active commuting category ranked 19th from the worst, out of a total of 57 activities.

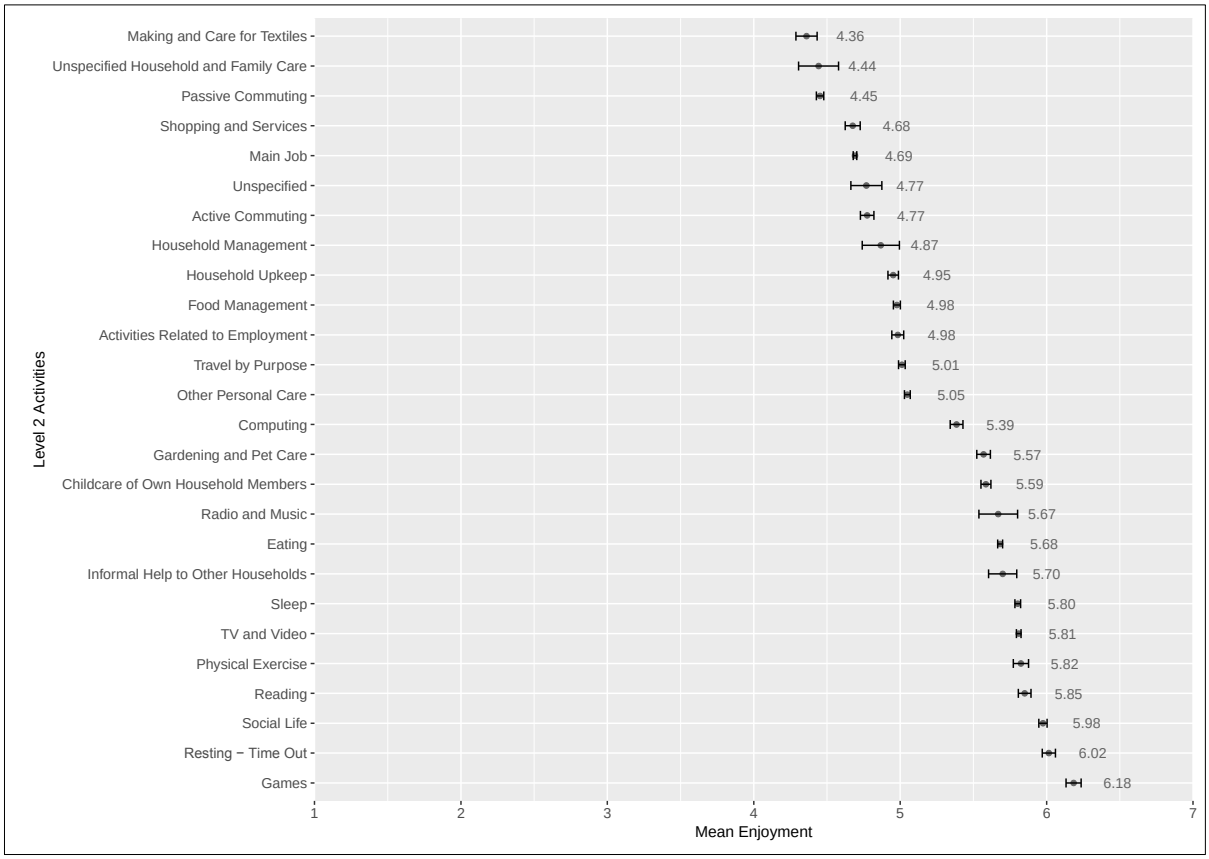

Figure 2. Mean enjoyment ratings by Level 2 activity. Error bars indicate one standard error.

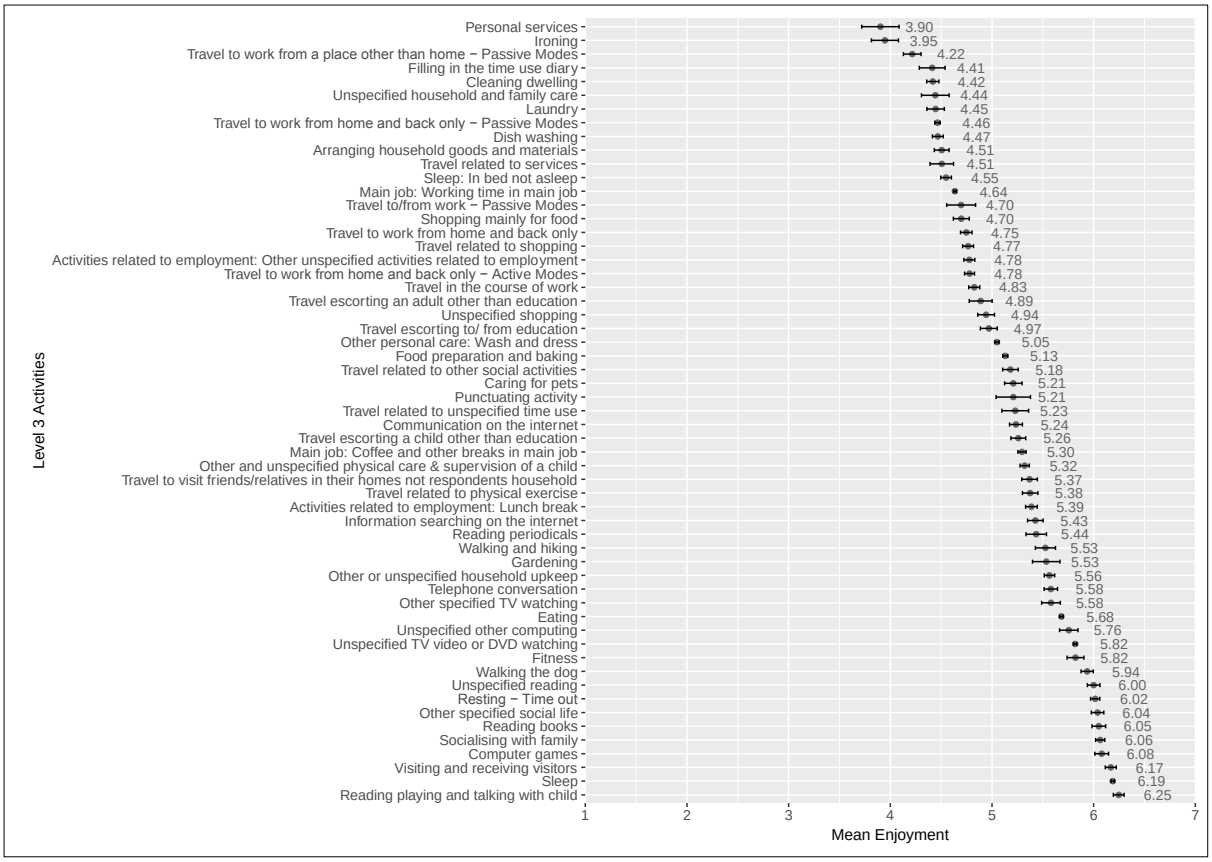

Figure 3. Mean enjoyment ratings by Level 3 activity. Error bars indicate one standard error.

Commuting vs Non-Commuting and Enjoyment of Daily Activities

In order to compare the effect of commuting against the effect of not commuting on the enjoyment ratings for all other daily activities, a series of multilevel analyses using R (R Core Team, 2017), lmerTest (Kuznetsova, Brockhoff & Christensen, 2017) and boot (Canty & Ripley, 2016) were conducted. The multilevel models accounted for the nested nature of the data, as multiple individuals could originate from the same household. This section presents the results of this analysis for activities that were coded on Level 1 and Level 2 only; Level 3 activities were not included in this analysis because of the small number of observations in individual activity categories.

Workday composition for Level 1 activities.

To gain a better understanding of the typical day on which (1) no commuting took place, (2) commuting took place using passive modes of transport, (3) commuting took place using active modes of transport, (4) and commuting took place using both passive and active modes of transport, the frequency of each Level 1 activity occurring for each of these groups was plotted in Figure 4. Visibly, the proportion of overall activities accounted for by each Level 1 activity is relatively equal for all four groups. The most notable differences are that a greater proportion of activities occurring on non-commuting workdays are classified as travel, and conversely, commuting workdays, especially those workdays on which commuting took place using both passive and active modes of transport, comprise of a larger proportion of employment related activities.

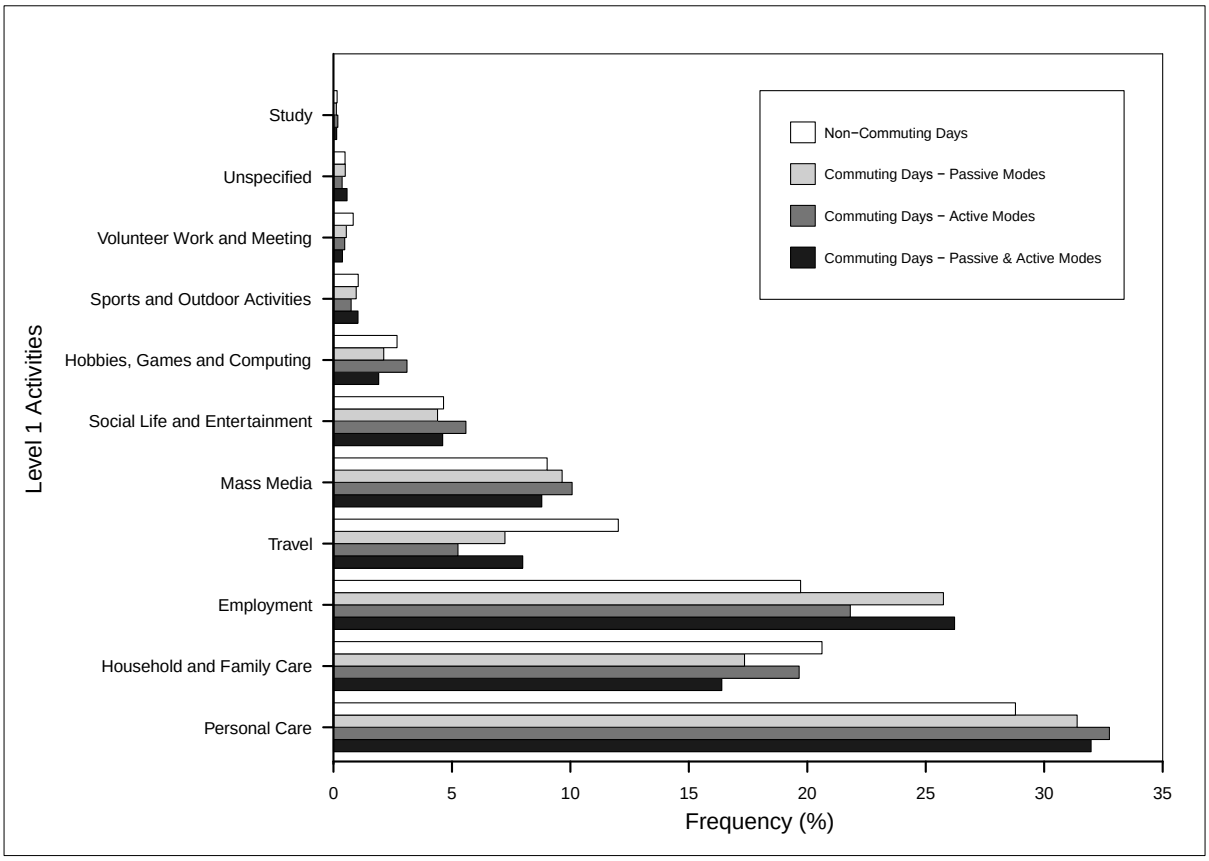

Figure 4. Proportion of overall activities attributed to each Level 1 activity category.

Level 1 multilevel analysis.

Mean enjoyment ratings for each of the Level 1 activities for episodes occurring on days on which the commute was carried out using passive modes, active modes and both passive and active modes are presented in Tables 5, 6 and 7 respectively. Only Level 1 activities that have at least 100 recorded episodes for both commuting workdays and non-commuting workdays were included in the analysis.

Table 5

Descriptive statistics of the enjoyment ratings for Level 1 activities, for both commuting workdays and non-commuting workdays, for passive modes of transport

Activities	Number of Episodes		Mean (Standard Error) of Enjoyment Ratings		
	Commuting	Non-Commuting	Commuting	Non-Commuting	Difference
Employment	9556	2591	4.73 (0.01)	4.95 (0.03)	-0.21*
Hobbies, Games and Computing	787	352	5.55 (0.05)	5.44 (0.07)	0.12
Household and Family Care	6439	2710	5.08 (0.02)	5.01 (0.03)	0.06
Mass Media	3582	1185	5.80 (0.02)	5.81 (0.03)	-0.01
Personal Care	11651	3783	5.51 (0.01)	5.64 (0.02)	-0.13*
Social Life and Entertainment	1630	610	5.97 (0.03)	5.92 (0.05)	0.05
Sports and Outdoor Activities	355	137	5.83 (0.06)	5.96 (0.09)	-0.13
Travel	2686	1580	5.00 (0.03)	4.99 (0.04)	0.02
Volunteer Work and Meeting	200	109	5.85 (0.09)	5.39 (0.16)	0.46*

* indicates statistical significance at the $p < 0.05$ level

Table 6

Descriptive statistics of the enjoyment ratings for Level 1 activities, for both commuting workdays and non-commuting workdays, for active modes of transport

Activities	Number of Episodes		Mean (Standard Error) of Enjoyment Ratings		
	Commuting	Non-Commuting	Commuting	Non-Commuting	Difference
Employment	1436	2591	4.74 (0.04)	4.95 (0.03)	-0.20*
Hobbies, Games and Computing	204	352	5.99 (0.08)	5.44 (0.07)	0.55*
Household and Family Care	1294	2710	5.05 (0.04)	5.01 (0.03)	0.04
Mass Media	663	1185	5.87 (0.05)	5.81 (0.03)	0.06
Personal Care	2156	3783	5.53 (0.03)	5.64 (0.02)	-0.10*
Social Life and Entertainment	368	610	6.08 (0.06)	5.92 (0.05)	0.16*
Travel	346	1580	4.96 (0.08)	4.99 (0.04)	-0.03

* indicates statistical significance at the $p < 0.05$ level

Table 7

Descriptive statistics of the enjoyment ratings for Level 1 activities, for commuting workdays and non-commuting workdays on which commuting took place using both passive and active modes of transport

Activities	Number of Episodes		Mean (Standard Error) of Enjoyment Ratings		
	Commuting	Non-Commuting	Commuting	Non-Commuting	Difference
Employment	2156	2591	4.69 (0.03)	4.95 (0.03)	-0.26*
Hobbies, Games and Computing	157	352	5.33 (0.10)	5.44 (0.07)	-0.11
Household and Family Care	1348	2710	4.92 (0.04)	5.01 (0.03)	-0.09
Mass Media	723	1185	5.68 (0.04)	5.81 (0.03)	-0.13*
Personal Care	2630	3783	5.32 (0.03)	5.64 (0.02)	-0.32*
Social Life and Entertainment	379	610	5.93 (0.06)	5.92 (0.05)	0.01

Travel	657	1580	4.92 (0.06)	4.99 (0.04)	-0.06

* indicates statistical significance at the $p < 0.05$ level

Using a series of multilevel analyses, the impact of commuting to/from work on the enjoyment of each of the other Level 1 activities was analysed. The multilevel models controlled for the fixed effects of age, sex, educational attainment, country of birth, relationship status, self-reported disability, self-reported health, interview mode, economic activity status and UK region (cf. Office for National Statistics, 2014b; Morris and Guerra, 2015). The models also controlled for the participant's usual working location, time spent on commuting during the day, duration of the episode being rated and time spent on the activity during the day up to the current point. The final variable accounts for changes in enjoyment that may occur due to the episode representing, for example, the 100th minute of the activity; this would not be captured by episode duration if the activity is split into multiple episodes throughout the day.

The results of the analyses for episodes occurring on days when commuting was carried out using passive modes, on days when commuting was carried out using active modes and on days when commuting was carried out using both passive and active modes are presented in Figures 5, 6 and 7 respectively.

The values in the figures are the estimated coefficients for commuting; they indicate the size of the effect that commuting has on the enjoyment rating when all other variables are held constant. Non-commuting workdays were assigned as the reference group in the models; thus, the bars indicate how much higher or lower the enjoyment ratings for each activity are for workdays when passive and active transport modes were used for commuting compared to non-commuting workdays. The values are based on the same 1 to 7 scale as the enjoyment ratings. When looking at the activity *Personal Care*, for example, this activity is enjoyed 0.19 points less, on a rating scale of 1 to 7, on workdays when both passive and active modes of

transport are used for commuting than on workdays on which no commuting takes place, when all other factors (age, sex, employment etc.) are held constant. This was the only meaningful difference that resulted from the model analysis at Level 1.

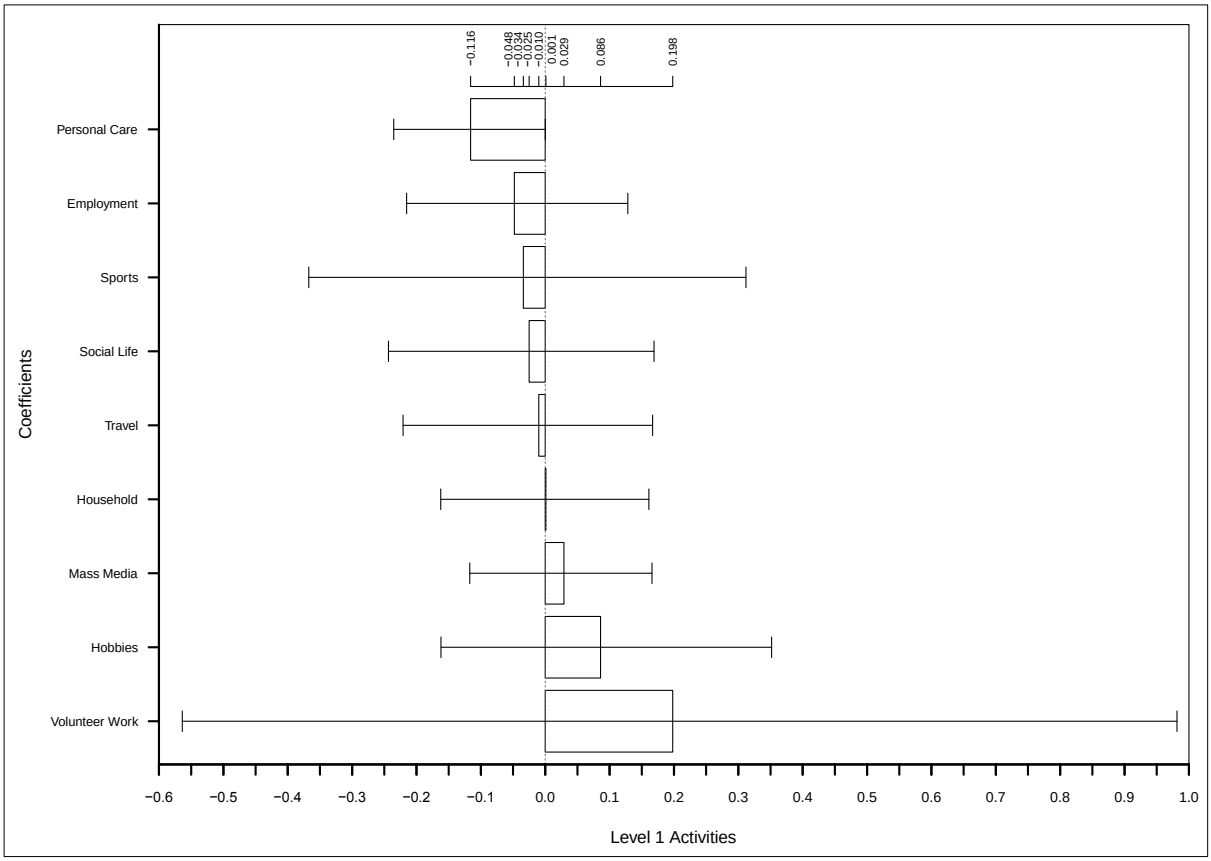

Figure 5. Difference in enjoyment ratings for Level 1 activities between non-commuting workdays and workdays on which commuting is undertaken using passive modes of transport, based on multilevel analysis. Error bars indicate bootstrapped confidence intervals.

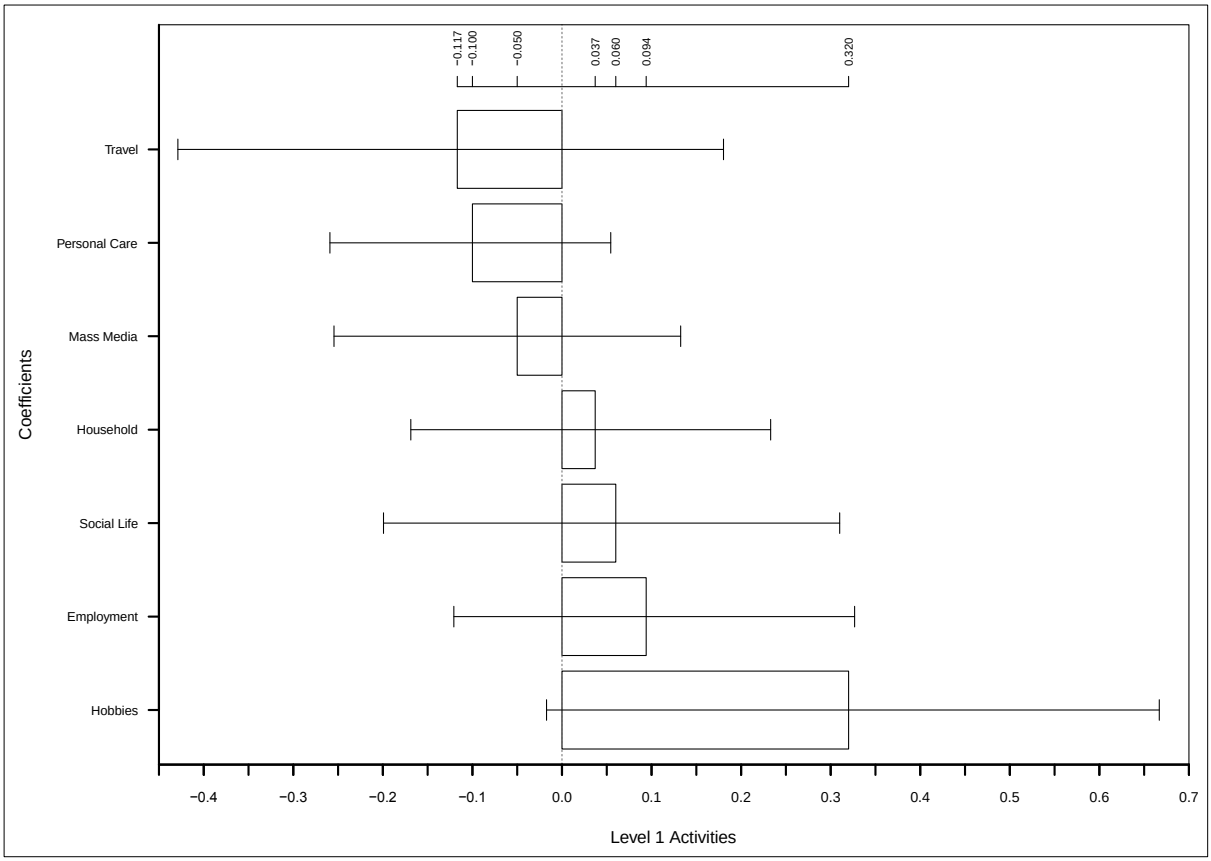

Figure 6. Difference in enjoyment ratings for Level 1 activities between non-commuting workdays and workdays on which commuting is undertaken using active modes of transport based on multilevel analysis. Error bars indicate bootstrapped confidence intervals.

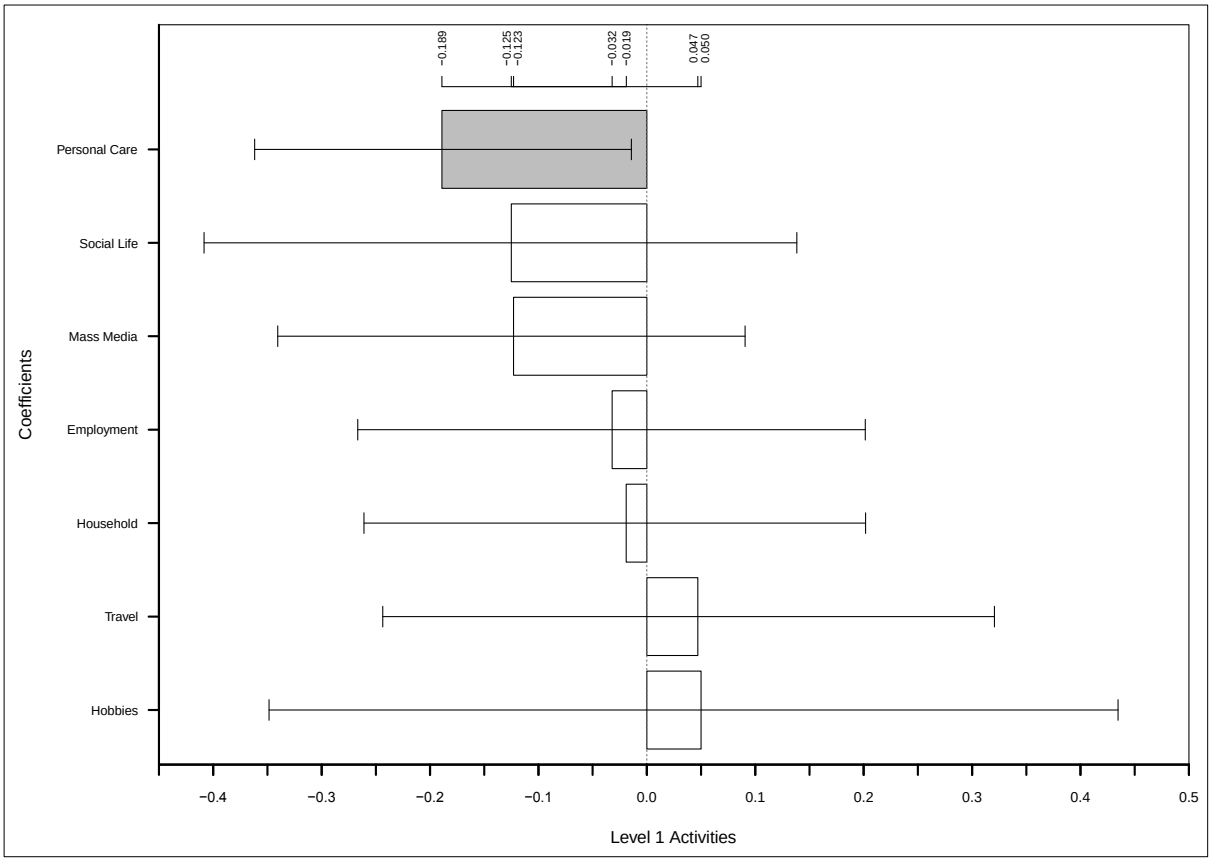

Figure 7. Difference in enjoyment ratings for Level 1 activities between non-commuting workdays and workdays on which commuting is undertaken using both active and passive modes of transport based on multilevel analysis. Error bars indicate bootstrapped confidence intervals.

Level 2 multilevel analysis.

Mean enjoyment ratings for each of the Level 2 activities for episodes occurring on days on which the commute was carried out using passive modes, active modes and both passive and active modes are presented in Tables 8, 9 and 10 respectively. Only Level 2 activities that have at least 100 recorded episodes for both commuting workdays and non-commuting workdays were included in the analysis.

Table 8

Descriptive statistics of the enjoyment ratings for Level 2 activities, for both commuting workdays and non-commuting workdays, for passive modes of transport

Level 2 Activities	Number of Episodes		Mean (Standard Error) - Enjoyment Ratings		
	Commuting	Non-Commuting	Commuting	Non-Commuting	Difference
Activities Related to Employment	855	133	4.98 (0.05)	5.01 (0.14)	-0.03
Childcare of Own Household Members	1010	458	5.66 (0.04)	5.38 (0.07)	0.28*
Computing	556	265	5.32 (0.06)	5.26 (0.08)	0.06
Eating	3511	1290	5.67 (0.02)	5.79 (0.03)	-0.12*
Food Management	2345	880	4.99 (0.03)	5.03 (0.05)	-0.04
Gardening and Pet Care	622	256	5.62 (0.06)	5.57 (0.08)	0.06
Household Upkeep	1272	491	4.96 (0.05)	4.83 (0.07)	0.13
Main Job	8690	2446	4.71 (0.02)	4.95 (0.03)	-0.24*
Making and Care for Textiles	328	135	4.45 (0.09)	4.57 (0.14)	-0.12
Other Personal Care	3933	1104	5.05 (0.03)	5.12 (0.05)	-0.08
Physical Exercise	343	134	5.83 (0.07)	6.02 (0.09)	-0.18
Reading	399	132	5.78 (0.06)	6.05 (0.08)	-0.26*
Resting - Time Out	484	176	6.05 (0.06)	5.75 (0.10)	0.30*
Shopping and Services	572	280	4.63 (0.06)	4.58 (0.10)	0.05
Sleep	4205	1389	5.82 (0.02)	5.91 (0.04)	-0.09
Social Life	1107	408	5.93 (0.04)	5.96 (0.06)	-0.03
Travel by Purpose	2686	1580	5.00 (0.03)	4.99 (0.04)	0.02

TV and Video	3096	1026	5.81 (0.02)	5.79 (0.03)	0.02

* indicates statistical significance at the p < 0.05 level

Table 9

Descriptive statistics of the enjoyment ratings for Level 2 activities, for both commuting workdays and non-commuting workdays, for active modes of transport

Level 2 Activities	Number of Episodes		Mean (Standard Error) - Enjoyment Ratings		
	Commuting	Non-Commuting	Commuting	Non-Commuting	Difference
Activities Related to Employment	147	133	4.99 (0.11)	5.01 (0.14)	-0.02
Childcare of Own Household Members	250	458	5.58 (0.09)	5.38 (0.07)	0.20
Computing	127	265	5.60 (0.11)	5.26 (0.08)	0.34*
Eating	656	1290	5.77 (0.05)	5.79 (0.03)	-0.02
Food Management	468	880	5.04 (0.06)	5.03 (0.05)	0.01
Household Upkeep	270	491	4.84 (0.09)	4.83 (0.07)	0.01
Main Job	1281	2446	4.71 (0.04)	4.94 (0.03)	-0.23*
Other Personal Care	733	1104	5.06 (0.06)	5.12 (0.05)	-0.06
Resting - Time Out	138	176	6.05 (0.10)	5.75 (0.10)	0.30*
Sleep	766	1389	5.79 (0.06)	5.91 (0.04)	-0.12
Social Life	215	408	6.14 (0.07)	5.96 (0.06)	0.18
Travel by Purpose	346	1580	4.96 (0.08)	4.99 (0.04)	-0.03
TV and Video	562	1026	5.86 (0.05)	5.79 (0.03)	0.07

* indicates statistical significance at the p < 0.05 level

Table 10

Descriptive statistics of the enjoyment ratings for Level 2 activities, for both commuting workdays and non-commuting workdays on which commuting took place using both passive and active modes of transport

Level 2 Activities	Number of Episodes		Mean (Standard Error) - Enjoyment Ratings		
	Commuting	Non-Commuting	Commuting	Non-Commuting	Difference
Activities Related to Employment	203	133	5.05 (0.10)	5.01 (0.14)	0.04
Childcare of Own Household Members	256	458	5.44 (0.09)	5.38 (0.07)	0.06
Computing	110	265	5.09 (0.12)	5.26 (0.08)	-0.17
Eating	785	1290	5.58 (0.04)	5.79 (0.03)	-0.21*
Food Management	490	880	4.82 (0.06)	5.03 (0.05)	-0.21*
Household Upkeep	252	491	4.81 (0.09)	4.83 (0.07)	-0.02
Main Job	1937	2446	4.64 (0.03)	4.95 (0.03)	-0.30*
Other Personal Care	932	1104	4.89 (0.05)	5.12 (0.05)	-0.23*
Shopping and Services	139	280	4.65 (0.12)	4.58 (0.10)	0.07
Sleep	913	1389	5.54 (0.06)	5.91 (0.04)	-0.37*
Social Life	278	408	6.03 (0.06)	5.96 (0.06)	0.07
Travel by Purpose	657	1580	4.92 (0.06)	4.99 (0.04)	-0.07
TV and Video	615	1026	5.65 (0.04)	5.79 (0.03)	-0.14*

* indicates statistical significance at the $p < 0.05$ level

A series of multilevel analyses were carried out for each of the Level 2 activities that had at least 100 recorded episodes for both commuting workdays and non-commuting workdays. The model covariates were the same as those used for the Level 1 analysis. The results of the analyses for episodes occurring on days when commuting was carried out using

passive modes, on days when commuting was carried out using active modes and on days when commuting was carried out using both passive and active modes are presented in Figures 8, 9 and 10 respectively.

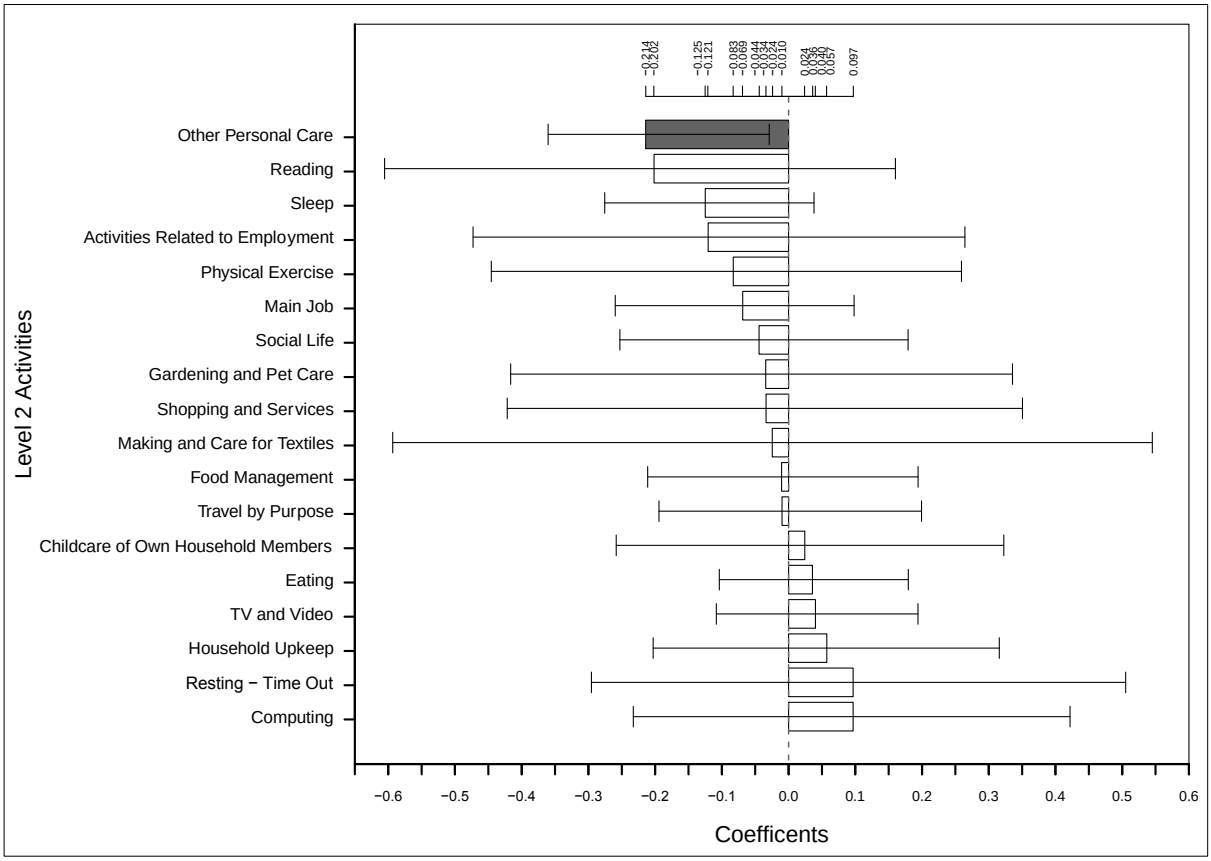

Figure 8. Difference in enjoyment ratings for Level 2 activities between non-commuting workdays and workdays on which commuting is undertaken using passive modes of transport, based on multilevel analysis. Error bars indicate bootstrapped confidence intervals.

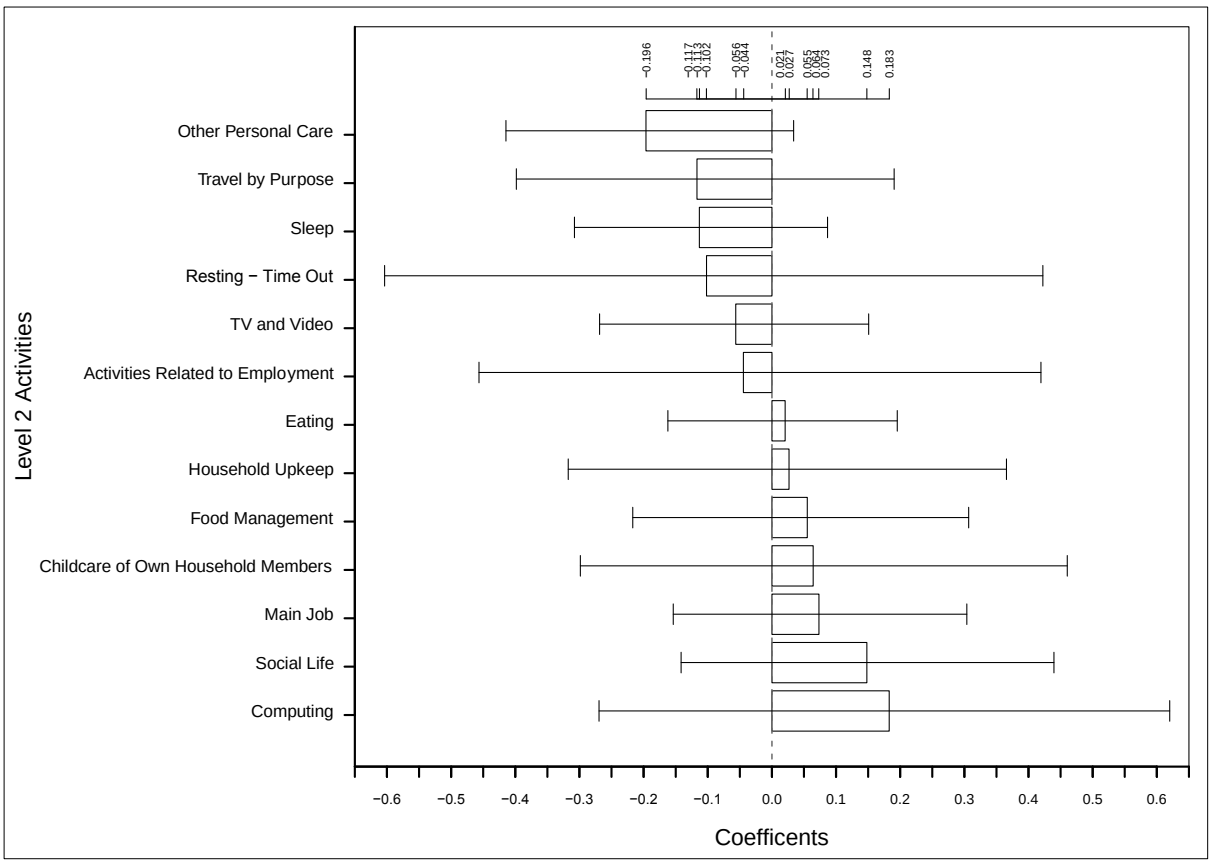

Figure 9. Difference in enjoyment ratings for Level 2 activities between non-commuting workdays and workdays on which commuting is undertaken using active modes of transport, based on multilevel analysis. Error bars indicate bootstrapped confidence intervals.

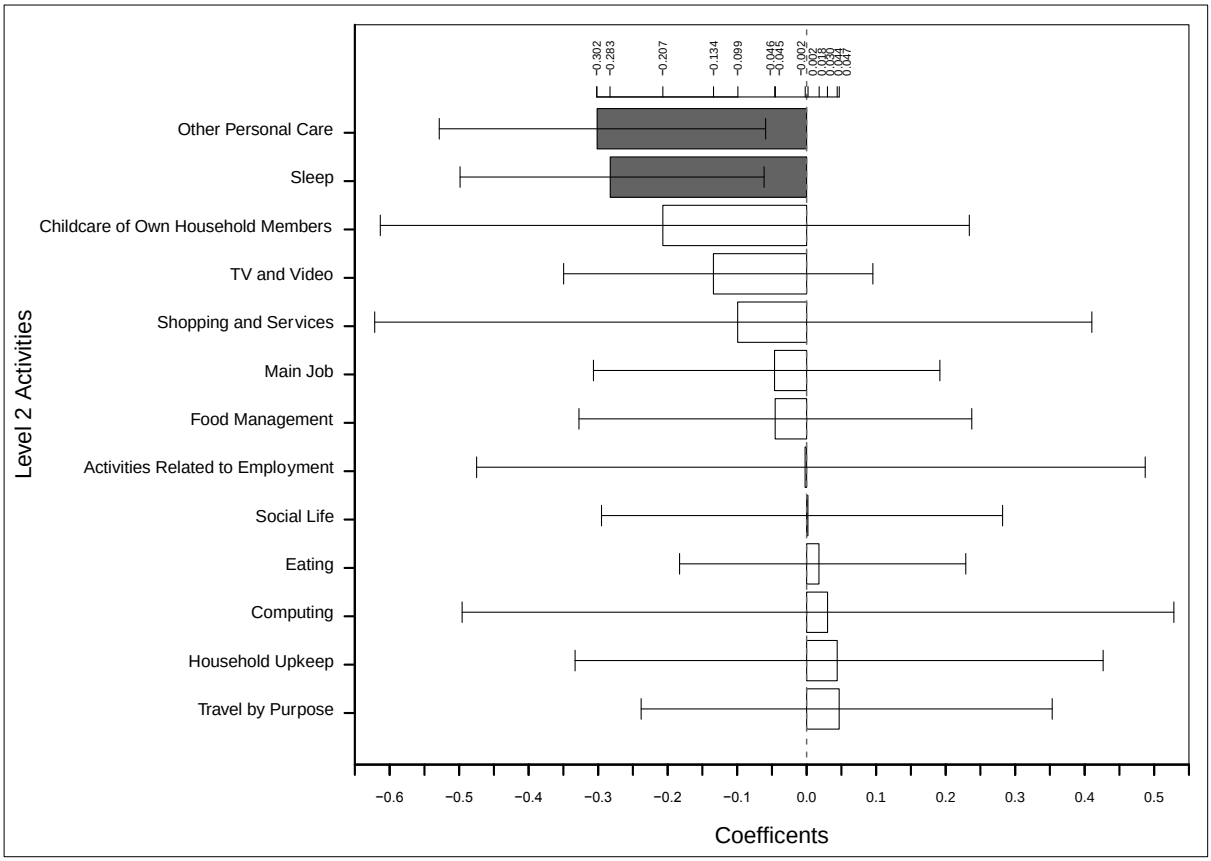

Figure 10. Difference in enjoyment ratings for Level 2 activities between non-commuting workdays and workdays on which commuting is undertaken using both active and passive modes of transport, based on multilevel analysis. Error bars indicate bootstrapped confidence intervals.

Level 2 analysis echoed the results of Level 1 analysis, finding that activities in the category of *Other Personal Care* were enjoyed less on workdays on which commuting took place using both passive and active modes of transport than on non-commuting workdays. At Level 2 analysis, this is also true for workdays on which commuting occurred using only passive modes of transport. The more granular Level 2 analysis also found *Sleep* to be enjoyed less on workdays on which the commute took place using both passive and active modes of transport than on non-commuting workdays. No meaningful difference in enjoyment, across any of the daily activities, was found between workdays on which commuting took place using active modes of transport and non-commuting workdays.

Finally, in order to test whether commuting leads to a decrement of the overall enjoyment one derives from all activities in a day, the average enjoyment rating across all activities that occurred on non-commuting workdays, workdays on which passive commuting took place, workdays on which active commuting occurred and workdays on which commuting occurred using both passive and actives modes were compared. Non-commuting workdays had an average enjoyment rating of 5.31, passive commuting workdays had an average rating of 5.19, active commuting workdays had an average rating of 5.29 and workdays that comprised of both passive and active commuting had an average rating of 5.01 (standard errors of .013, .008, .017 and .015 respectively). The median values for the enjoyment ratings were 5 for all four groups. As such, overall enjoyment was lower on workdays on which both active and passive commuting occurred than the other groups. Active commuting workdays and non-commuting workdays were found to be the most enjoyable overall with negligible differences between the two.

Discussion

This study explored the relationship between commuting and experienced well-being in the context of other daily activities in the UK. Firstly, the activity of commuting was compared to other daily activities, in terms of their experienced well-being, here represented by the enjoyment ratings of those activities. Secondly, the effect of commuting was assessed by comparing the experienced well-being of other daily activities between workdays on which commuting took place using passive modes of transport, on which commuting took place using active modes of transport, on which commuting took place using both passive and active modes of transport and on which commuting did not take place. The results for each part of the study are discussed in turn.

How Commuting Compares to Other Daily Activities

Commuting was found to be the least enjoyable daily activity, when using passive modes of transport and when assessed at the most coarse level of activity categorisation. This is in agreement with Kahneman *et al* (2004), who also found commuting to be the least enjoyable daily activity, and with Stone and Schneider (2016) who found commuting to be the worst ranked activity for the meaningfulness and happiness dimensions. Here, active commuting ranked fourth from the lowest; and whilst this ranks commuting as one of the least enjoyed activities, the mean enjoyment rating for the activity was significantly greater than that for passive commuting.

Taking a more granular look, passive commuting ranked 24th out of 26 daily activities. Whilst this is similar to the findings of White and Dolan (2009), in our study only *Making and Care for Textiles* and *Unspecified Household and Family Care* ranked lower. Both of these activities correspond to the single activity of *Housework* within the White and Dolan study, who also found *Shopping and Work* to rank lower than commuting for ratings of pleasurableness. Active commuting ranked 20th out of the 26 daily activities in our study.

In the previously reported results based on UK data, Bryson and MacKerron (2017) found commuting to rank 34 out of 40 activities on their measure of happiness. The results of the present study, with commuting workdays split into passive and active modes, highlight the negative role of passive commuting. This is significant as this paper is the first to carry out this analysis using data that is representative of the UK population. However, this result should be interpreted with caution since our dependent variable was different from that used by Bryson and MacKerron (2017).

Each of the four papers that assessed the experienced well-being effects of daily activities used different, albeit related, activity categories; these were listed in Table 1. Three of the papers included a table of mean affect ratings for each activity. For comparative

purposes, the activities included for each of these three papers have been grouped, where possible, to produce broader categories that are present across all three studies, detailed in Table 11; each of the studies contained additional activities that did not correspond to activities contained within the other studies and were omitted from this exercise. The mean positive affect ratings for the eight newly formed activity categories for the three studies, as well as the present UKTUS study, are presented in Figure 11. The average of the scores from all four studies is also plotted. The activities are ordered based on the ratings achieved according to our UKTUS study. To keep the data structure in line with the other studies, the UKTUS ratings were not split into passive commuting and active commuting for this analysis.

Table 11

Details of the measures and categories used to form comparative activities for the studies that compared daily activities based on their subjective well-being effects

Paper Authors, Year	Measures used for Comparison	Categories used to form Activities used for Comparison
Kahneman *et al*, 2004	Average of descriptors within the Positive descriptors category, figures provided in the paper	**Commuting:** Commuting **Work:** Working **Shopping:** Shopping **Household:** Housework and Preparing Food **Eating:** Eating **Sports:** Exercising **Religious:** Pray/Worship/Meditate **Leisure:** Relaxing, Watching TV, Computer/Email/Internet, and Socialising
White and Dolan, 2009	Average pleasure scores which were derived through *affect-balance tradition* using the Feeling items, figures provided in the paper	**Commuting:** Commute **Work:** Work **Shopping:** Shopping **Household:** Housework and Cook **Eating:** Eat **Sports:** Exercise and Outdoor Activities **Religious:** Pray, Meditate **Leisure:** Rest/Relax, Listen to Music, Watch TV, Read/Use Internet, and Socialise
Stone and Schneider, 2016	Happy, figures provided in the paper	**Commuting:** Work-Bound Commuting, and Home-Bound Commuting **Work:** Work **Shopping:** Consumer Purchases **Household:** Household Activities **Eating:** Eat Drink **Sports:** Sports Recreation **Religious:** Religion Spiritual **Leisure:** Socialise/Leisure/Relax
Present Study	Enjoyment Ratings	**Commuting:** Travel to/from Work, Travel to Work from Home and Back Only, and Travel to Work from a Place Other Than Home **Work:** Employment **Shopping:** 6 Level 3 Activity Codes **Household:** 6 Level 2 Activity Codes **Eating:** Eating **Sports:** Sports and Outdoor Activities, and Sports Events **Religious:** Religious Activities, and Resting-Time Out **Leisure:** 3 Level 1 Activity Codes: (1) Social Life & Entertainment (Except For One Level 3 Activity Code Referring to Telephone Conversations), (2) Hobbies, Games & Computing, and (3) Mass Media.

Each of the studies posed the question assessing the degree to which the emotion was experienced on a scale from *not at all* to *very much/very strongly*. Thus, the mean positive affect rating of 0.5 represents a neutral response to the question. The majority of the affect ratings were greater than 0.5 and only ratings obtained from the White and Dolan study fell below 0.5, as can be seen in Figure 11. This indicates that the individuals surveyed in these studies generally enjoyed/took pleasure in/were happy carrying out the activities in their day. The resultant rankings, therefore, allow us to identify the comparative positive affect of each activity, they do not suggest that those ranked at the bottom constitute a negative part of an individual's day.

The absolute figures for the ratings achieved, when normalised, are quite similar for three of the studies; only the ratings from the White and Dolan study are significantly lower

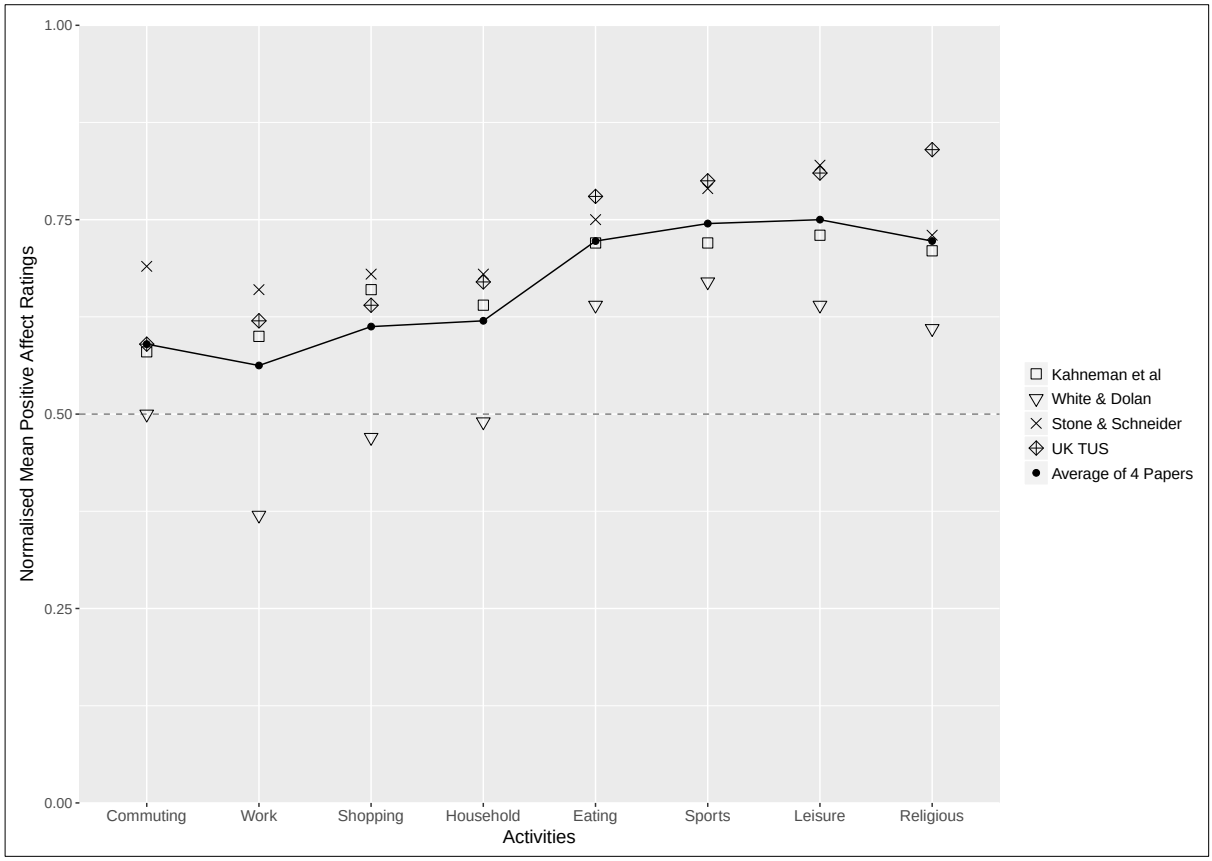

Figure 11. Mean positive affect ratings for comparative activity categories for three previous studies and the present study.

for each activity category. The lower ratings may be due to cultural differences as it is the only study conducted in Germany; Kahneman *et al* and Stone and Schneider used data obtained within the US and the present study is based in the UK. Additionally, each of the studies focused on different subjective well-being dimensions, as detailed in Table 1. Differences in affect ratings, therefore, could simply be attributed to the fact that participants were asked to rate their activities on a different dimension.

The rankings obtained from the present study are most similar to those from the earliest study conducted by Kahneman and colleagues. All of the studies ranked *Commuting*, *Work*, *Shopping* and *Household* as the four worst activities in the day in terms of positive affect ratings. The average affect rating for each activity, represented by the line on the graph, shows that, collectively, the studies broadly agree with the rankings obtained in the present study.

Commuting vs Non-Commuting and Enjoyment of Daily Activities

Personal Care is enjoyed more on workdays on which commuting does not take place than on workdays on which commuting takes place using passive modes of transport, according to the multilevel analyses conducted in the second part of this study. The same is true for workdays on which commuting takes place using both passive and active modes of transport; however, in this case, *Sleep* is also found to be less enjoyable than on non-commuting workdays. No meaningful difference was found in the enjoyment experienced on non-commuting workdays compared to workdays on which commuting takes place using active modes of transport for any of the daily activities. Notably, for the vast majority of activities, with the exception of only *Personal Care* activities and *Sleep*, there were no meaningful differences in enjoyment between any of the three commuting workday groups and non-commuting workdays, including *Employment*.

The link between working from home and greater employment related well-being has been well researched with respect to evaluative well-being. Studies have shown that the enhanced perceived autonomy achieved through telecommuting leads to greater job satisfaction (Gajendran & Harrison, 2007; Fonner & Roloff, 2010). Investigating this relationship at the experienced well-being level has only recently become the focus of research. Anderson, Kaplan and Vega conducted the first of these studies in 2015, finding that employees experience more job-related positive affective well-being and less job-related negative affective well-being on days when teleworking, compared to days when they worked in the office. The findings of the present study contribute to the growing literature in this field.

This was the first study to compare the experienced well-being effects of daily activities between commuting workdays and non-commuting workdays. The only other similar comparative study was between commuters and non-commuters, conducted by the ONS, which looked at four well-being questions that did not relate to specific activities throughout the day, focusing instead on the day, or life, taken as a whole (Office for National Statistics, 2014b). One of the findings of that study stated that commuters were less happy than non-commuters. The ONS study grouped participants based on their usual working location whereas the focus of the present study was on workdays on which commuting did, or did not, take place; non-commuting workdays consisted of both those that usually commute to work and those that usually telecommute. Despite the difference in focus, the present study provides findings consistent with the ONS study but also offers a more nuanced perspective: higher levels of enjoyment are experienced on non-commuting workdays than on commuting workdays, however, this only applies to some parts of the day and for workdays that include passive modes of transport for at least part of the commute.

Research has recently begun to focus on employment-related geographical mobility (E-RGM). Cresswell *et al* (2016) explain how this term within "mobilities" research corresponds

to "who and what are impacted and implicated" by patterns and variabilities of mobility. Numerous mobilities studies have discussed the theoretical implications of travel; for example, Brömmelstroet *et al* (2017) explored the exposure to social and spatial diversity afforded by different modes of transport and related this to feeling a sense of connectedness. The results of the present study offer quantitative findings that could enrich the research on E-RGM, contributing to a richer understanding of the role of transport for people's well-being.

Strengths and Limitations

This is the first study to compare the experienced well-being effects of daily activities between commuting workdays and non-commuting workdays, and the first study that is representative of the UK population to explore how commuting compares to other daily activities in terms of experienced well-being. This study is the second study to use Time Use Survey data but the first to use the UK based data; unlike the American dataset, the UKTUS included affect ratings for each activity recorded throughout the day.

Commuting was assessed as a whole in this study, however, distinguishing between the commute to work and the commute from work would have been a useful and informative extension of this work. Previous studies that looked at this more refined classification of commuting, such as the one carried out by Stone and Schneider (2016), found significant differences between the experiential well-being effects of these two activities. This level of analysis was not possible for the present study as the UKTUS data does not contain separate activity codes for each. It is also important to note that whilst the random intercept models used for analysis in this study controlled for observed demographic characteristics, there may be systematic differences that were unaccounted for. The UKTUS queried only one measure of experienced well-being for the daily activities recorded; complimenting this with an additional

dimension, preferably a dimension measuring negative affect, would provide a much richer data source for future research.

Conclusion

The findings of this study add to the growing literature on the relationship between commuting and experienced well-being. Whilst commuting to and from work has been found to be the least enjoyable part of the day when using passive modes of transport and one of the least enjoyable activities when using active modes of transport, significantly more enjoyment is derived from this time when actively commuting. Commuting has been shown to have little impact on an individual's enjoyment of the other daily activities in which they partake. Enjoyment across all daily activities was found to be just as high on active commuting workdays as on non-commuting workdays. With the exception of only *Personal Care* activities and *Sleep*, there were no meaningful differences in enjoyment of any daily activities between any of the three commuting workday groups and non-commuting workdays, including, most notably, *Employment*.

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